

# DAZZLER

GENERAL  
TECHNICAL  
INFORMATION

# THE TV DAZZLER<sup>TM</sup>

## INTRODUCTION

The TV DAZZLER color graphics interface is an exciting new accessory for the Altair 8800 computer. The Dazzler can be used to generate action games, animated displays, educational learning drills, graphs, or even light shows all in full color on the screen of your color television set. The Dazzler is manufactured by CROMEMCO, ONE FIRST STREET, LOS ALTOS, CALIFORNIA, 94022. The Altair 8800 computer is manufactured by MITS, 6328 Linn N.E., Albuquerque, New Mexico, 87108.

The Dazzler is built on two boards designed to plug directly into the Altair 8800 computer. The video output of the Dazzler can be connected directly to the input of the video amplifier of a color TV set. By using an optional RF modulator, the Dazzler can be conveniently connected to the antenna terminals of the TV set, rather than to the input of the video amplifier.

With Dazzler, TV games that are either unavailable, or available only in black-and-white, can now be programmed in full color. A football can now sail over a bright green playing field under the software control of your computer. Rocket ships can spew red-yellow flames against a brilliantly blue sky. Or perhaps you wish to challenge your computer to a game of checkers or chess on a red and black playing board - again generated on your TV by Dazzler under the control of your computer.

If you use your computer for business or accounting purposes, Dazzler can be used to display multi-colored graphs of the data stored in your computer. Your computer can be used to process and format the raw data while Dazzler displays histograms, charts, or graphs of the data on your color TV display.

The Dazzler can also be used to turn your color TV into a TV terminal. Alphanumeric characters entered from your teletype or ASCII keyboard can be displayed directly on the screen of your color TV. By the same token, messages can be generated internally in your computer and displayed - in full color. Alphanumeric messages, titles, or comments can similarly be displayed in conjunction with Dazzler games or Dazzler graphic displays.

Another use of Dazzler is in computerized instruction either at home or in the classroom. Word recognition tests, "flash card" arithmetic drills, and memory training can all be carried out with the excitement of a full color display. Games can be interspersed with learning exercises to maintain student interest and enthusiasm.

Still another application of the Dazzler is in displaying the picture produced by the Altair Cyclops Camera. The output of the Cyclops camera can be processed by your computer and the output displayed on your TV screen. Applications include security systems, pattern recognition tasks, and automated measurement and control systems. Either a processed or unprocessed Cyclops picture can be displayed, complete with alphanumeric subtitles generated by your computer.

## DESIGN

The Dazzler is a very advanced design using over 70 MOS and TTL integrated circuits on two printed circuit boards. Yet the Dazzler is easy to build. A special varnish or "solder mask" is used to guard against shorts during board construction. And a legend mask is silk-screened directly on the boards to show precisely where each component is placed.

Only the highest quality parts are used in Dazzler. The printed circuit boards are double-sided glass-epoxy with plate-through holes and gold-plated edge contacts. IC sockets are used for all dual-in-line integrated circuits. And carbon-film resistors are used for high-speed operation and temperature stability.

The two Dazzler boards may be plugged directly into two adjacent slots in the Altair computer. A 16-conductor ribbon cable, with DIP plugs on each end, is used to interconnect the two boards. Alternatively Board 2 may be mounted "piggyback" on Board 1 so that only one slot of the Altair is required for the Dazzler. In this configuration seven additional jumper wires must be used to interconnect Board 1 with Board 2.

## SOFTWARE

Complete software support is also available for the Dazzler. Software for the fabulous game of LIFE in FULL COLOR is now available. Software is also available for the game of HEXPAWN. Dazzle-writer software is available for using your Dazzler and color TV as a COLOR TV TERMINAL. Software for many other games is currently under development.

**Page 5 missing**



## OPERATION

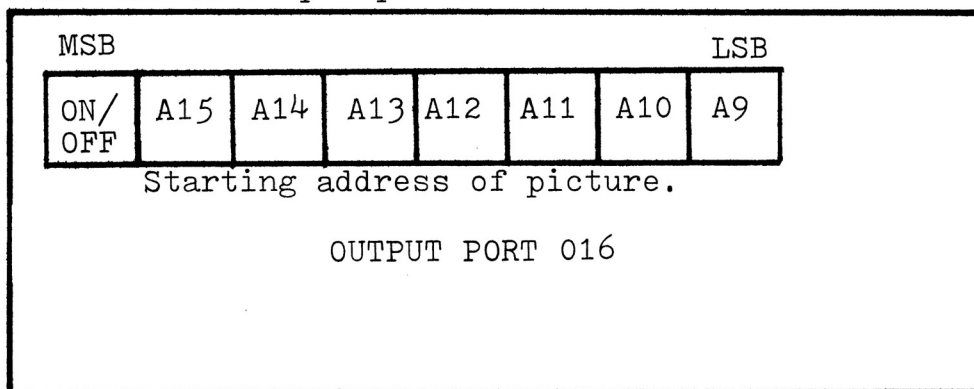
The Dazzler uses high-speed direct memory access (DMA) to read the memory of the host computer, and translates the information in the memory into a color TV signal. The key advantage of using DMA is that the Dazzler can display a picture while at the same time the computer is executing either a related or unrelated program. Only a 15% slow-down of the computer execution is realized during Dazzler operation.

A functional block diagram of the Dazzler is shown on page 5. A 3.579545 MHz crystal oscillator is used to generate the color video subcarrier. The video output amplifier delivers a standard 1-volt negative sync NTSC video signal into a 52 ohm load. A six-foot length of 52 ohm coax cable is supplied with every Dazzler.

While the video output signal is generated by Board 1, Board 2 is used to communicate with the computer. A high speed (one million bytes per second) DMA controller is the heart of this board. The controller issues a "Hold" command when it is ready to access the computer memory. When the computer finishes the current machine cycle it issues a "Hold Acknowledge" signal to begin DMA.

In addition to the high-speed DMA data link, two output ports and one input port are built into Dazzler Board 2 for the exchange of control signals between the computer and Dazzler. These are output ports 016 and 017 (octal) and input port 016 (octal).

The most significant bit of output port 016 is used to enable or disable the Dazzler. A "1" at this bit location turns the Dazzler on. A "0" turns the Dazzler off. The Dazzler can also be turned off manually by depressing the "clear" switch on the Altair front panel. The remaining seven bits of output port 016 are used to set the starting location of the picture to be displayed in the computer's memory. As will be discussed below, the picture may require 512 bytes of memory or 2K bytes of memory depending on the mode in which the Dazzler is operating. In any event this must be static memory with an access time of 1 microsecond or faster. A summary of the use of output port 016 is shown below:



Output port 017 is used to set the format of the TV picture. The function of each of the eight bits of this output port is shown in this table:

### DAZZLER OUTPUT PORT 017

D7 - Not used.

D6=1-Resolution X 4. Color and intensity set by D4 to D0:

D6=0-Normal resolution. (32X32 for 512-byte picture. 64X64 for 2K-byte picture.) Color and intensity of each picture element set by 4-bit words in the computer memory.

D5=1-Picture in 2K bytes of memory.

D5=0-Picture in 512 bytes of memory.

D4=0-Black-and-White picture.

D4=1-Color picture.

D3=1-High intensity color.

D3=0-Low intensity color.

D2=1-Blue

D2=0-No blue

D1=1-Green

D1=0-No green

D0=1-Red

D0=0-No red

In resolution X 4 black-and-white mode, D3 is the most significant bit of 4-bit intensity control word.

:  
:  
:

Bit D0 is the least significant bit.

Bit D7 is not used. Bit D6 is used to set normal resolution (32X32 element picture for 512 bytes or 64X64 element picture for 2K bytes) or resolution X 4 (64X64 element picture for 512 bytes or 128X128 element picture for 2K bytes). Bit D5 sets the amount of computer memory (starting at the location given to output port 016) allocated to the picture. When D5 is "1" 2K bytes of memory are used. When D5 is "0" 512 bytes are used. Bit D4 is used to select between a black-and-white display and a color display. Bits D3 - D0 are used in resolution X 4 mode to set the color of a color picture or the intensity of a black-and-white picture. Bits D3 - D0 are not used in normal resolution mode.

Only two bits of input port 016 are used. Bit D7 is low during odd lines and high during even lines. Bit D6 goes low for 4 milliseconds between frames to indicate end of frame.

D7 ODD LINE/ EVEN LINE	D6 END OF FRAME
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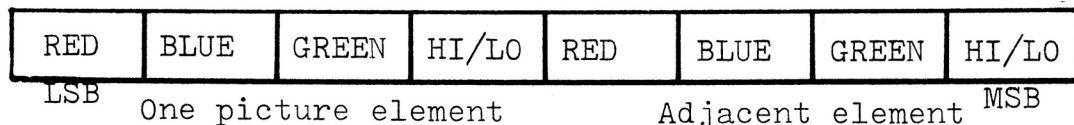
ONLY TWO BITS OF INPUT  
PORT 016 ARE USED.

In order to generate a TV picture with Dazzler, the information that the Dazzler reads from the computer memory must be properly formatted. In resolution X 4 mode each point on the TV screen is controlled by just one bit in the computer memory. When that bit is a "1" the corresponding element of the picture is on. When that bit is a "0" the picture element is off. In resolution X 4 mode the color and intensity of the picture is set by bits D0 to D3 of the control word at output port 017. For full color in resolution X 4 mode, multiple frames of different colors must be interleaved.

In normal resolution mode the color and intensity of each element of the TV picture are controlled by a four-bit "nybble" in the computer memory. Two elements of the picture are thus stored in each byte (8 bits) of memory. (For this reason a 64X64 picture in normal resolution mode requires 2K of memory.) The lowest order bit of each nybble (D0) determines whether the corresponding element of the picture contains red (1) or no red (0). Similarly D1 controls green, D2 controls blue, and D3 sets either high intensity or low intensity color. In black-and-white mode these four bits are instead used to specify one of 16 levels of gray.

When writing programs for Dazzler displays it is important to remember that the TV picture is stored as a special coded sequence in the computer memory. The Dazzler simply interprets this code to form a TV picture. Two different codes are used depending on whether the Dazzler is used in normal resolution mode or in resolution X 4 mode (as set by the control word sent to output port 017).

In normal resolution mode four bits of computer memory are used to code each element of the picture. A 32X32 picture requires 512 bytes of memory. A 64X64 picture requires 2K bytes of memory. The following diagram shows how the 4-bit code works:



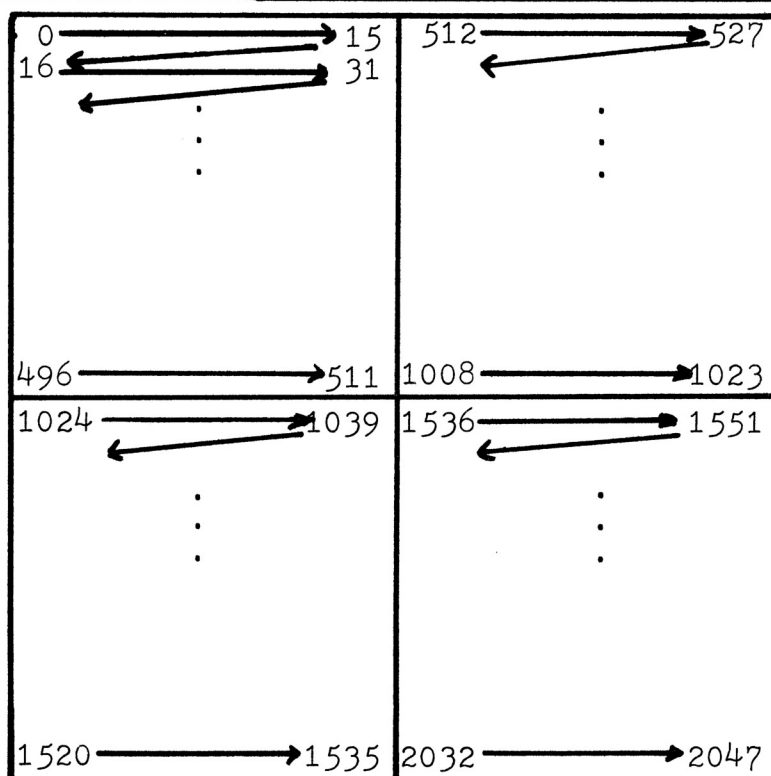
IN NORMAL RESOLUTION MODE ONE BYTE OF MEMORY IS USED TO REPRESENT TWO ADJACENT ELEMENTS OF THE PICTURE.

In resolution X 4 mode each bit of the memory is used to either turn on or off a single element of the picture. The eight picture elements controlled by a single byte have the following geometric relationship:

D0 LSB	D1	D4	D5
D2	D3	D6	D7 MSB

IN RESOLUTION X 4 MODE ONE BYTE OF MEMORY IS USED TO REPRESENT EIGHT ADJACENT ELEMENTS OF THE PICTURE.

The 2K byte Dazzler picture is stored in memory as four quadrants. Each quadrant of the picture occupies one 512-byte page of memory. Only one page of memory is displayed for a 512-byte picture. The sequence in which memory is scanned in making a 2K byte picture is shown below:



MEMORY MAP OF DAZZLER PICTURE. FIRST QUADRANT IS DISPLAYED FOR 512-BYTE PICTURE. ALL FOUR MEMORY QUADRANTS ARE DISPLAYED IN 2K BYTE PICTURE.

### EXAMPLE PROGRAM

The following program is useful for testing the operation of the Dazzler and is useful for initial tune-up. To operate this program you must have 2K bytes of static memory beginning at location zero in memory.

<u>Memory location</u>	<u>Memory contents</u>	<u>Comments</u>
000 000	076	Move immediate into the accumulator
000 001	200	
000 002	323	Output to port number 016
000 003	016	
000 004	333	Input from the sense switches
000 005	377	
000 006	323	Output to port number 017
000 007	017	
000 010	303	Jump to memory location 000 000
000 011	000	
000 012	000	

This program begins by putting the bit sequence "10000000" into the accumulator and outputting it to port 016. This turns on the Dazzler and tells it that the picture that it is to display begins at location zero in memory. Next the program uses the front panel sense switches to set the control word sent to output port 017. This allows the user to experiment with different output formats and appreciate the fantastic versatility of the Dazzler display. When sense switch A12 is raised the Dazzler goes into color mode, and a colorful quilt-like pattern will appear on the TV screen.

### TUNE UP

The tune up procedure for the Dazzler is straightforward. Begin by loading and running the above sample program. Raise SSW A12. Potentiometer R 29 is the horizontal hold control. Adjust R 29 for a stable picture on your screen. Now raise SSWs 10,11,12,13,14. Adjust C17 for the brightest blue color on your screen. Now lower SSW A10 and raise A9. Adjust R28 for the brightest green. Finally lower SSW A9 and raise SSW A8. Adjust R27 for brightest red. The tune up of Dazzler is now complete.

## TV CONNECTION

A length of RG174U coaxial cable is provided to connect the Dazzler to your TV. The center conductor of the cable should be soldered to the pad labeled "OUT" on Board 1. The shield of the cable should be soldered to the adjacent foil ground. The other end of this cable can be connected to the input of the video amplifier of a TV, being sure to terminate the cable in a 52-ohm impedance.

If you prefer to connect to the antenna terminals of the TV, rather than to the video amplifier input, a RF modulator is required. One such modulator is the Pixieverter Model #PXV-2A available for \$8.50 from ATV RESEARCH, 13th and Broadway, Dakota City, Nebraska, 68731. If you use a Pixieverter you must also use a matching transformer between the output of the Pixieverter and the TV set. A standard 75 ohm to 300 ohm matching transformer, available at TV supply stores, will provide the required matching. (Radio Shack stores carry such a transformer for \$2.59, model #15-1140).

## Servicing your DAZZLER

Under normal operation your Dazzler should function for years without requiring service. Should you have to troubleshoot your Dazzler, the DAZZLER TROUBLESHOOTING GUIDE on the following pages provides a step-by-step procedure.

One common problem can occur when several boards are used simultaneously on the bus of the Altair 8800 computer. This problem is caused by the inability of the +8 volt supply of the Altair to deliver an adequate supply voltage under load. This problem may show up as a series of dark bars on your DAZZLER picture. One cure to this problem we have found is to connect a very large filter capacitor (approximately 100,000 microfarads @ 10 volts) across the Altair 8-volt supply line.

Another common problem is caused by the inability of some dynamic memory boards to maintain memory integrity during DMA operation. Since the DAZZLER uses DMA to extract the picture from the computer's memory, we recommend that static memory boards be used for both picture and program storage during DAZZLER operation.

## USING TWO DAZZLERS IN YOUR COMPUTER

If you wish to control two TV sets simultaneously, you can use two DAZZLERS in your computer at the same time. To synchronize the DAZZLERS remove the jumper wire connecting "SYNC IN" to "G" on Board 1 of one of the DAZZLERS. Now connect "SYNC OUT" from the other DAZZLER to the SYNC IN pad that use to be connected to "G". The two DAZZLERS are synchronized with this connection so that they may be operated simultaneously in the same computer.

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CROMEMCO DAZZLER Debugging HintsEquipment Required

- 1) VTVM or VOM
- 2) Triggered sweep oscilloscope, preferably DC-5MHz or more, with an external sync input.
- 3) Frequency counter (optional)
- 4) Altair 8800 and color TV set with direct video adapter

Procedure

- 1) Measure the output of each regulator (IC1 & IC38) to be between +4.75 and +5.25 VDC, with less than .1VPP of 60 or 120Hz ripple. If low voltage or excessive ripple exists, check that primary power at regulator input is always >7V, and check IC1 & 38.
- 2) Measure point "V" with oscilloscope and verify a ~3VPP square wave at 3.579545MHz. The counter can be used to set the frequency with the 7-25pf trimmer to an accuracy of +500Hz or better.
- 3) Measure IC7P4&6 to also see ~3VPP square wave at 3.579MHz.
- 4) Measure point "W" to verify a 4.5 us wide pulse going from +3 to 0 at a 15.98 KHz rate. If not present, check IC's 32, 33, 21, 19, 31, 30, 36, and sync jumper.
- 5) Measure IC5P8 to verify a .25ms wide pulse going from +3 to 0 at a 62Hz rate. If not present, check IC's 3, 9, 18, 19, 11, 12, 5, 36, and sync jumper.
- 6) Measure "Sync Out" to verify a 62us wide pulse from 0 to +3 at 62Hz rate. If not present, check IC6.
- 7) Measure IC23P9 to verify a 12ms wide + pulse at a 62Hz rate. If not present, check IC 2, 4, 8, 23.
- 8) Measure point "S" to verify a 35.8us wide + pulse at a 15.98KHz rate. If not present, check IC 19, 29.
- 9) Depress the Altair "CLR" switch & verify IC63P8 is at 0 (or IC4P12 at +3). If does not clear, check IC 58, 63, 66.
- 10) Load the following Basic Test program into static RAM, starting at address 0 in the Altair and start execution at 0 with the RAM protected. If it won't reset or load, go to A.
 

loc 0:	076	333	303
	200	377	000
	323	323	000
	016	017	
- 11) Stop and run the program several times to verify that it stays in the address range 0 to 128. If not, or if it won't execute, go to A.



- 12) With the program in (10) executing, the DAZZLER is enables to display the first portion of memory, with the sense switches controlling output port 017. Verify the following switch control responses:

D0 to IC37P16	D4 to IC61P1
D1 to IC37P10	D5 to IC61P14
D2 to IC37P9	D6 to IC61P11
D3 to IC37P15	D7 to IC61P8

- If not present, check IC 37, 61, 72, 39, 48, 49, 45, 58, 59.
- 13) Verify that IC54P1, 14, 11, 8 and IC63P1, 14, 11 are at 0V and IC63P8 is +3V.  
If not present, check IC 71, 72, 54, 63, 65, 66, 58, 48.
- 14) Temporarily change the instruction at loc 1 to 377 and execute. Verify that IC54P1, 14, 11, 8 and IC63P1, 14, 11, 8 are at +3. If not, check same IC's as in (13). Restore loc 1 to 200 & Run.
- 15) Stop execution. Verify IC63P8 is +3. Depress CLR switch and verify IC63P8 is now 0V. Put back in RUN. If does not clear, check IC 58, 66.
- 16) Set sense SW D5=0. Verify IC60P9, 6, 2, 15 and IC62P9, 6, 2 are 0. Temporarily change instruction at loc 1 to 377 and execute. Verify IC60P9, 6, 2, 15 and IC62P9, 6, 2 are at +3. If incorrect action, check IC 52, 60, 62. Restore loc 1 to 200 & Run.
- 17) Measure IC18P12 and verify a 47us wide + pulse with 62.5us period (15.98KHz). If not present, check IC 18, 21, 22, 29.
- 18) Connect the scope for external + sync and obtain sync from IC23P9. Measure IC2P12 and verify a burst train of 313us wide pulses from +3 to 0 at a 62.5Hz burst rate, for a total of 32 pulses/burst. Pulse leading edges are spaced 375us. If not present, check IC 2, 3, 8, 10, 13, 19.
- 19) Observe that setting sense SW D5=1 doubles the number of pulses. Leave D5=0. If not, check IC 3, 13.
- 20) Measure IC23P6 and verify a burst train of 47us wide + pulses with a 62Hz burst rate. The pulse leading edges should be spaced 250us for a total of 32 pulses/burst, with pulses spaced 62.5us between the bursts. If not present, check IC 9, 23.
- 21) Observe that setting sense SW D5=1 doubles the number of pulses in the slower portion. Leave D5=0.
- 22) Measure point "T" to verify a + pulse train burst at a 62Hz rate consisting the slower portion of the waveform in (20). If not, check IC 40.
- 23) Connect the scope external + sync to point "T" and set the time base to 5us/div so "T" is + during most of visible trace. Measure IC8P6 to verify a burst of pulses from +3 to 0 occurring while "T" is positive.



For D5=0, there should be 33 pulses of width 280ns with 2.23us between leading edges. For D5=1, there should be 65 pulses 280ns wide, spaced 1.11us except for the first pair spaced 2.23us. Leave scope sync on "T". If not correct, check IC 8, 20, 21, 22, 30, 32, 33.

- 24) Measure IC57P12 to verify a + pulse each time pulse at "T" occurs, with a leading edge delay of 1-5us and a trailing edge delay of .5-1us. If not present, check IC 39, 40, 47, 48, 49, 56, 58, 66, 57. Also check for signals on PHOLD and PHLA, and priority input greater than +3.
- 25) Measure IC41P12 to verify a pulse train similar to IC41P1, except with the first pulse deleted for either position of D5. If not present, check IC 41, 42, 43, 44, 49, 52, 58. CAUTION: Note IC 44 is specially selected. Use of a non-selected part may require adding 560pf from IC44P5 to ground to allow proper circuit operation.
- 26) Measure IC50P12, 9, 8, 11 to verify that the horizontal address counter operates in a binary fashion while "T" is high. IC51P12 operates only if D5=1. If not operating, check IC 50, 51, 49.
- 27) Measure IC 51P9, 8, 11 and IC53P9, 8, 11 to verify Binary operation of the vertical address counter. IC53P11 operates only if D5=1. Use "T" for scope sync. If not correct, check IC 51, 52, 53, 71, 13.
- 28) If the static RAM at 0 being read out by the DAZZLER was not cleared to 0 prior to loading and execution of the test program, it should contain a random pattern of 1's and 0's. Measure IC47P11, 6, 3, 14 and IC 55 P11, 6, 3, 14 to verify random data reception while "T" is high. If not present, check IC 47, 55, 64, 72.
- 29) Measure IC43P9 to verify presence of a square wave with period .5us for D5=1 and 1.11us for D5=0. If not present, check IC 13, 43.
- 30) Measure IC46P4, 7, 9, 12 to verify the presence of random data when "T" is high. If not present, check IC 41, 46.
- 31) Measure IC24P11 to verify bursts of 64 pulses from +3 to 0, pulses are a square wave of .56us period, with bursts beginning every 62.5us. If not present, check IC2.
- 32) Set D6=0. Verify point "H" is at 0. If not, check IC 61.
- 33) Measure points A, B, C, and D to verify presence of random data while "T" is high. If not present, check IC 13, 34, 35, 36, 26, 27, 49, 67, 70, 68, 69.
- 34) Measure points A,B,C,D to verify similar random data occur in the intervals when T is low. If not present, check for -12V at IC24P12, and check IC 24, 34.
- 35) Set D4, D5, and D6=0 on sense switches. Measure IC25P6 to verify +3V. If not present, check IC7, 25, 61.

- 36) Set D4=1 and verify +3 at IC25P11 and 0 at IC25P6. If not, check IC 7, 25.
  - 37) With D4=0, measure IC15P3, 6, 8, 11 to verify presence of the random memory data. Set D4=1 and verify all IC 15 outputs are approximately +3.
  - 38) With D4=1, measure IC16P6, 8, 12 and IC17P6, 8, 12 to verify presence of the random memory data modulated by the 3.58 MHz color subcarrier. If not present, check IC 16, 17, 25.
  - 39) Measure IC14P6 to verify presence of a composite + sync pulse train containing 15.98KHz and 62Hz pulses. If not present, check IC 14.
  - 40) Using point "W" for scope sync, verify presence of a 3.58MHz burst at IC14P8 occurring just after the horizontal sync pulses on IC14P6. If not present, check IC 14.
  - 41) Connect a 50 ohm load to the video output. Set D4=D5=D6=0. Adjust the 500 ohm "DC" pot in the video amplifiers so the most negative portion of the waveform (sync tips) is at +0.5VDC across the 50 ohm load. The more positive portions of the waveform may reach to +1.5VDC. If not possible, check the resistor values, transistors, and diode.
  - 42) Connect the video output to a color TV direct video input through 50 ohm coax with a termination. An illuminated square consisting of a patchwork of many colors should fill the center of the screen if D4=1, with D4=0 producing a picture in shades of grey. D5 should control whether 32 or 64 squares are in each direction. Setting D6=1 will blank out the screen unless at least one of D0, D1, or D2 are ON.
  - 43) If only the first line of each square appears correct, check IC 24, 34.
  - 44) If all or part of the squares in a line are duplicated from left to right, or lateral jitter appears in the image, check IC44. Try adding 560pf from IC44P5 to gnd.
  - 45) If some type of symmetry or duplication occurs in the display of a static RAM whose contents should be random, check IC 49, 67, 68, 69, 70.
  - 46) If the memory doesn't read out, check IC 67, 70.
  - 47) When measuring any particular signal, keep in mind the fact that a PCB short can cause extraneous added pulses.
- 
- A) Measure IC57P12 and verify it stays 0V. If not, check IC 40, 47, 48, 56, & 57. If point "T" is staying at +3V, remove IC 40 and connect IC40P6 to ground. If IC57P12 is still not 0V, check for a 2MHz square wave at IC57P8, 9.
  - B) With IC57P12 at 0V, attempt steps 9, 10, & 11 again. If unsuccessful, check IC 49, 65, 66, 67, 68, 69, 70, 73. Continue at (9). If IC 40 was

left out, replace it between steps 21 & 22, and add a shorting jumper from IC57P12 to ground. Remove the shorting jumper before step 24.

- 48) If two IC outputs are accidentally shorted together by the PCB, two important effects occur:
  - a) Since most gates have greater pull down capability than pull-up, the result is the logical OR of the two separate, desired signals.
  - b) At the times when one gate is pulling up and the other is pulling down, the logic signal will be in the range of 0.4 to 1.0V instead of the usual logic 0 range of 0 to 0.4V.
- 49) Gate outputs are never exactly 0V or +5V unless there is a direct short.

CROMEMCO  
ONE FIRST STREET  
LOS ALTOS, CALIFORNIA  
94022

# DAZZLER

## SCHEMATIC & FOIL DIAGRAMS

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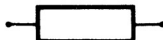



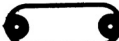
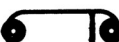
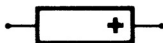

# DAZZLER

ASSEMBLY MANUAL

## DAZZLER ASSEMBLY INSTRUCTIONS

The assembly of the DAZZLER<sup>TM</sup> kit requires about one evening. All components are mounted on the component side of the pc boards and soldered to the foil on the opposite side. Be sure to use high-quality rosin core solder for the assembly and a fine-tipped low wattage soldering iron. IC sockets must be used for all ICs (except for the voltage regulators IC1 and IC38)

To facilitate the assembly of your DAZZLER kit, the part number of every component is printed in position on the component side of each pc board. The following symbols are used on the pc board:

	$\frac{1}{4}$ watt carbon film resistors	
		Inductors
	Miniature potentiometers	
	Capacitors	
	Diodes (Band denotes cathode end)	
	Electrolytic capacitors	
	Transistors.	

### Assembly of DAZZLER Board 1

- (✓) Solder in position IC sockets for ICs 2 through 37. Solder a 16 pin IC socket in the position labeled "TO BOARD NO. 2".
- (✓) With a heatsink mounted between IC1 (LM340T-5.0 voltage regulator) and the pc board, secure this IC in position using 6-32 hardware. Solder the three leads in place.
- (✓) Solder in position capacitors C1 - C14 (0.1 uF disc ceramic capacitors).
- (✓) Solder in position filter capacitors C15 and C16 taking care to orient the positive (+) lead of each capacitor towards the bottom of the pc board.
- (✓) Solder in position the variable capacitor, C17. Note that the lead on the capacitor marked with an arrow goes in the hole location farthest from the XTAL. If the capacitor does not fit easily into its mounting holes, gently crimp the leads on the capacitor with a pair of needle-nose pliers before inserting it.



### Assembly of DAZZLER Board 1 (Cont.)

- (✓) Solder in position the disc ceramic capacitors C18 (180 pF); C19,20,21 (560 pF); C22 (.001); C23,24 (220 pF); C25,26 (.001); C27 (56 pF).
- (✓) Solder in place a small jumper wire, as shown, between the pads labeled "IN" and "G" on the opposite side of the board.
- (✓) Solder in place the 1N5242 Zener diode (D1) taking care to position the cathode end of the diode toward the top of the pc board. The cathode end of the diode is marked with a band.
- (✓) Solder in position diode D2 (1N914). Take care to orient the diode so that the cathode (banded) end is toward the top of the board.
- (✓) Solder in place the inductors L1 and L2. The inductors L1 and L2 are identical.
- (✓) Solder in position the  $\frac{1}{4}$  watt 5% carbon film resistors R1 - R26.
- (✓) Solder in position the three 500-ohm miniature potentiometers R27, R28, and R29. These three potentiometers are identical.
- (✓) Solder in position transistor Q1 (2N3906) taking care to position the flat face of the transistor toward the top of the pc board.
- (✓) Solder in position transistors Q2 and Q3 (2N3904) taking care to position the flat face of the transistors toward the bottom of the pc board.
- (✓) Solder in place the 3579.545 KC crystal (XTAL). The crystal should be mechanically secured in place by running a small piece of bare wire from the pad just under the crystal, over the top of the crystal to the pad just above the crystal. The wire should be pulled tight and soldered at each pad.
- ( ) Insert the ICs from envelope #1 into their sockets on Board 1. TAKE SPECIAL CARE TO SEE THAT EVERY IC IS PROPERLY ORIENTED IN ITS SOCKET AND THAT EACH PIN OF EVERY IC IS PROPERLY ENGAGED IN THE SOCKET.

### Assembly of DAZZLER Board 2

- (✓) Solder in position IC sockets for ICs 39 through 73. Solder a 16 pin IC socket in the position labeled "TO BOARD NO. 1". DO NOT solder IC sockets in the positions labeled "NO IC".
- (✓) With a heatsink mounted between IC38 (LM340T-5.0 voltage regulator) and the pc board secure this IC in position using 6-32 hardware. Solder the three leads in place.
- (✓) Solder in position capacitors C28 - C39 (0.1 uF disc ceramics).

### Assembly of DAZZLER Board 2 (Cont.)

- (✓) Solder in position the filter capacitors C40 and C41 taking care to orient the positive (+) lead of each capacitor toward the bottom of the pc board.
- (✓) Solder in position R30, a 1K  $\frac{1}{4}$ -watt 5% carbon film resistor.
- (✓) Solder in position the seven port selection jumper wires. The jumper wires should connect pad J1 to J1; J2 to J2; J3 to J3, etc.
- (✓) Insert the ICs from envelope #2 into their sockets on Board 2. Be sure to use the selected 7474 IC for IC44. TAKE SPECIAL CARE TO SEE THAT EVERY IC IS PROPERLY ORIENTED IN ITS SOCKET AND THAT EACH PIN OF EVERY IC IS PROPERLY ENGAGED IN THE SOCKET.

### Interboard connection

- ( ) A 16-conductor cable, with plugs on each end, is provided to connect Board 1 to Board 2. The cable should be plugged into the socket labeled "TO BOARD NO. 2" on the front of Board 1, be routed over the top of Board 1 down the front of Board 2 and into the socket on Board 2 labeled "TO BOARD NO. 1".

### T.V. connection

- ( ) A length of RG174/U cable is provided to connect the Dazzler to your TV. The center conductor of the cable should be soldered to the terminal labeled "OUT" on Board 1. The shield of the cable should be soldered to the adjacent foil ground. The other end of this cable can be coupled to the input of the video amplifier of a TV. If you prefer to connect to the antenna terminals of the set rather than to the video amplifier input, a RF modulator is required. The most cost-effective modulator that we know of is the Pixieverter available for \$8.50 from ATV Research, 13th and Broadway, Dakota City, Nebraska, 68731.

### Final check

- ( ) Before using your DAZZLER carefully inspect your work. The notch on every IC should be on the left (with pin 1 of each IC toward the lower left). Be sure that all components are in the proper positions and properly oriented. Also check to be sure that you have installed the small jumper wire shown near the top of Board 1. For instructions on tuning up your Dazzler refer to the DAZZLER General Technical Information Manual supplied with your kit.

### Service

If for any reason you need service on your DAZZLER you may return the DAZZLER to Cromemco along with a check for \$35. The \$35 covers the cost of repair, tune-up, and return postage. We reserve the right to not repair any DAZZLER that we judge to be unserviceable (e.g. if it is built without IC sockets).

# DAZZLER KIT - PACKING LIST

<u>Envelope #1</u> <u>ICs Board 1</u>	<u>Envelope #2</u> <u>ICs Board 2</u>	<u>Envelope #3</u> <u>Capacitors</u>	<u>Envelope #4</u> <u>Resistors</u>
1 3417	1 LM340T-5.0	1 56 pF	1 10 ohms
1 LM340T-5.0	1 7402	1 180 pF	1 39
4 7400	2 7404	1 Variable	1 150
2 7404	5 74LS04	2 220 pF	1 220
1 74LS04	3 7405	3 560 pF	1 270
3 7408	2 7408	3 .001 uF	3 330
4 7410	1 74LS08	26 0.1 uF	1 470
2 7420	1 74LS10	4 Filters	3 500 (pot)
1 7430	1 74LS30		1 820
2 7432	1 7432		3 1K
3 7473	1 7474		1 1.5K
2 7474	1 7474 (Selected)		1 7.5K
1 74LS75	3 7475		1 9.1K
2 7493	2 7483		4 10K
1 74151	3 7493		3 15K
3 74157	1 7495		1 18K
2 74161	1 74157		1 30K
2 74175	2 74175		1 36K
	4 74367		1 62K

<u>Envelope #5</u> <u>Misc.</u>	<u>Envelope #6</u> <u>Inductors</u>	<u>Envelope #7</u> <u>Nameplate</u>
2 Heatsinks	2 22 uH (L1,L2)	1 Nameplate
2 #6 screws		
2 #6 nuts		
1 2N3906		
2 2N3904		
1 1N914		
1 1N5242		
1 Crystal		

## Other

## Optional (\$215 kit only)

1 16 conductor interconnect cable	25 16 pin IC Sockets (24 reqd)
1 6' length of RG174/U coax cable	50 14 pin IC Sockets (49 reqd)
1 DAZZLER Assembly Manual	
1 DAZZLER Schematic diagrams and Foil diagrams	
1 DAZZLER General Technical Information Manual	

Please report any shortages immediately to our Sales Office: CROMEMCO,  
ONE FIRST STREET, LOS ALTOS, CALIFORNIA, 94022. Phone: (415) 941-2967